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# Einstein Aggregation Operators with Cubic Fermatean Fuzzy Sets

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**Abstract.** The selection of optimal locations for electric vehicle (EV) charging stations is a complex multi-criteria decision-making (MCDM) problem influenced by quantitative and qualitative factors. The inherent uncertainty in these evaluations further complicates the decision-making process. This study introduces an integrated decision-making framework based on Cubic Fermatean Fuzzy Sets (CFFS) to address these challenges. We extend the work of three novel aggregation operators including Cubic Fermatean Einstein Fuzzy Weighted Averaging (CFEFWA), Cubic Fermatean Einstein Fuzzy Ordered Weighted Averaging (CFEFOWA), and Cubic Fermatean Einstein Fuzzy Weighted Averaging (CFEFHWA) to enhance decision accuracy in uncertain environments. Additionally, we propose innovative Einstein aggregation operations to integrate decision data effectively. The proposed framework is applied to a real-world EV charging station selection case study. Comparative analysis with existing methodologies demonstrates that our approach improves decision consistency and reliability. The results indicate that the proposed method enhances the robustness of decision-making by effectively handling uncertainty and providing more precise rankings for optimal site selection. These findings underscore the potential of CFFS-based MCDM approaches in complex decision-making scenarios, offering valuable insights for sustainable EV infrastructure planning.

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**Key Words and Phrases**: Fuzzy sets, Multi-Criteria Decision Making, Cubic fermatean fuzzy set, Einstein

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## 1. Introduction

Support for fossil fuel-based transportation negatively affects both the environment [1–5] and the economy. Speaking of the weakening of fossil vigor and ecological concerns, requires finding viable replacements for conservative vehicles. Electric vehicles (EVs) and their charging positions are a flattering essential answer to these glitches [6]. Zhang [7] offered an innovative ranking technique for PFNs. Xu et al. [8] presented the geometric aggregation operators. Xu [9] introduced the intuitionistic fuzzy weighted averaging operator. Zadeh [10] introduced the fuzzy set. Parvathi [11] introduced the intuitionistic fuzzy set. Garg et al. [12] proposed the Fermatean fuzzy Yager hybrid weighted geometric operators. Several Fermatean fuzzy aggregation operators were proposed by Aydemir et al. [13]. Chen [14] proposed the bridge selection of the construction method of a multiple-criteria decision-making problem. Chen [15] proposed the ultimate priority orders of the alternative. Chen [16] proposed the various forms of preference structures of the criterion weights using incomplete data in decision-making. A few methods for resolving Pythagorean fuzzy multiple attribute decision-making problems were developed by Wu et al. [17]. A likelihood-based linear assignment model for multiple criteria decision analysis in the interval-valued intuitionistic fuzzy environment was developed by Wang et al. [18]. In their proposal, Akram et al. [19] addressed how to handle Fermatean fuzzy data in MADM issues. Introducing the intuitionistic fuzzy set was Atanassov [20]. Yager [21] introduced the membership grades for Pythagoreans. Yang [22] introduced the managerial implications of the user-choice paradigm. Yang et al. [23] conducted a socioeconomic analysis was conducted in a proportionately reluctant, hazy setting. A Decision Support System (DSS) was examined by Sarabi et al. [24] to choose the best logistic service provider among the three services of the businesses. A Fermatean fuzzy TOPSIS method was developed by Senapati et al. [25] to address the problem of multiple criteria decision-making. Senapati et al. [26] developed a Fermatean fuzzy weighted product model to solve the multi-criteria decision-making problem. The Fermatean fuzzy weighted average and Fermatea fuzzy weighted geometric operators were proposed by Senapati et al. [27]. Large-scale data consideration by Shahraki et al. [28]. The features and applications of the proposed metrics in pattern recognition were proposed by Singh et al. [29]. The single-valued neutrosophic sets of the MULTIMOORA technique were proposed by Stanujkic et al. [30]. Stanujkic et al. [31] proposed single-valued bipolar fuzzy numbers of the MULTIMOORA method. Aliya et al. [32] proposed the VIKOR method to solve the MCDM method based on triangular cubic fuzzy numbers. The generalized triangular cubic linguistic hesitant fuzzy hybrid averaging operators were first presented by Amin et al. [33]. The TrCFEHWA operator was developed by Aliya et al. [34]. The triangular cubic fuzzy hybrid aggregation was proposed by Aliya et al. [35]. Different features of these operators were proposed by Aliya et al. [36], who also deduced the link between the proposed operators [37]. The ideal location for EV charging stations has been the subject of extensive research. For instance, training has focused heavily on reducing controller loss overall, bus dominance, and the attractiveness of the sending scheme's dependability through the Distribution Network Operator tilt [8, 11, 38–41]. While Wang et al. [18] and

Deb et al. [42] have promoted the development and installation of charging stations, Turk et al. [43] emphasized the need of taking EV weight and its effects on delivery schedules into account. Furthermore, the theoretical foundation of fuzzy set-based decision-making has been expanded by noteworthy investigations [7], such as those conducted by Zhang and Xu [44] and Zeng et al. [45]. To address the uncertain multi-criteria decision analysis difficulties, Rani et al. [46] were introduced. The suggested 3,4-quasirung fuzzy weighted averaging (geometric) operators are used by Seikh et al. [47] and have been applied in various fields [27, 48–52]. Numerous dynamic problems for existence, uniqueness, and numerical simulations had their foundation established by Khan et al. [53]. The uniqueness and Hyers-Ulam stability of the solutions to the mABC-FDEs system are examined by Khan et al. [54]. Lagrange's interpolation was introduced by Khan et al. [3] to build computationally efficient numerical algorithms for the fractal-fractional waterborne illness model. The Hyers-Ulam stability of the considered equation was presented by Khan et al. [2] and other fileds [4, 5, 38]. Das et al. [55] proposed a method for solving group decision-making problems (DMPs) using an intuitionistic fuzzy parameterized (IFP) intuitionistic multi-fuzzy N-soft set. Das et al. [56] introduced an effective water pollution rating system, the fuzzy multi-criteria decision-making (FMCDM) model, to calculate a relative weighted water pollution score (-score) for assessing pollution levels. Their approach is applied to evaluate the water quality indices of the Haora River in Tripura, India. Das et al. [57] introduced a modified adjustable GDMM for solving FSS-based GDMPs, replacing absolute scores with weighted average ratings to enhance stability and feasibility. Das et al. [58] proposed and defined novel concepts, including the root mean square difference operator (RMSDO), the root mean square difference score matrix (RMSDSM), and the weighted score. Das et al. [59] proposed an approach for solving real-life group decision-making problems (DMPs) using fuzzy parameterized intuitionistic fuzzy soft sets. In advance of earlier research, there is still a lack of information in the literature about the thorough integration of sophisticated fuzzy set theories with transport and electrical network considerations. More specifically, not enough research has been done on the use of cubic Fermatean fuzzy sets in the framework for choosing the location of EV charging stations. Comparing CFFSs to typical interval-valued fuzzy sets, they provide a more accurate and nuanced assessment of possible sites because they better capture uncertainty and flexibility. To close this gap, this study suggests a unique framework that improves the precision and dependability of EV charging station site selection by fusing CFFSs with multi-criteria decision-making techniques. The rest of the paper is structured as follows: Section 2 defines the operational laws and cubic Fermatean fuzzy numbers. Section 3 describes the aggregation operators using CFF data. Section 4 details the multi-criteria decision-making process using the CFF classical. Section 5 offers a case study of the EV charging position location selection problem, representative of the practical implementation of the proposed framework. Section 6 deliberates the comparative examination. In section 7, we define the discussion. Finally, Section 8 delivers the conclusion.

### 1.1. Contribution

In this subsection, we define the contribution given below
• Developed the idea of Cubic Fermatean Fuzzy Sets to deliver a more nuanced symbol of uncertainty and multi-criteria decision-making in the setting of EV charging station assortment.
• To develop the three aggregation operators CFEFWA, CFEFOWA and CFEFHWA operators.
• Offered innovative Einstein aggregation acts to effectually aggregate decision data within the CFFS outline, speaking of complexity and indecision of multi-criteria executive.

### 1.2. Motivation

The motivation of this article is a demarcation of the Cubic Fermatean Fuzzy Sets.
• The goal of this research is to provide more reliable tools for aggregating and evaluating decision data, which enhance the decision-making process correctness and dependability, creating new Einstein aggregation operators specifically designed for CFFS.
• To maximize charging station usefulness, minimize operating costs, and guarantee broad accessibility, all of which promote environmental sustainability and economic efficiency, they must be located efficiently.
• The process of choosing where to put EV charging stations is intrinsically complicated and involves several considerations, including financial considerations, infrastructure preparedness, user convenience, and geographic coverage.
• The interplay of these components is often too complex for traditional decision-making techniques to handle, particularly when the decisions involve both objective measurements and subjective judgments. Advanced techniques that can successfully integrate and balance these many requirements are needed.
• Practical applications of advanced fuzzy set theories to real-world issues are becoming more and more in demand. The necessity to implement and test novel approaches in the context of choosing locations for EV charging stations is what spurred this research.
• The research intends to give tangible evidence of the advantages and practical benefits of the proposed methods by comparing them with existing ways and using a case study to demonstrate their efficacy.

### 1.3. Objective

The objective of the research is given below
• To develop the CFS and operational laws
• To develop three aggregation operators including CFEFWA, CFEFOWA, and CFEFHWA operators.
• To develop the proposed method based on CFEFWA operators.
• To develop a numerical example.

## 2. CFFN and operational laws on Einstein

**Definition 1.** *The fixed set C and the A is defined in* $A = \left\{ \begin{array}{c} \langle [E_A^-(u), \\ E_A^+(u)], \\ E_A(u)\rangle, \\ \langle [L_A^-(u), \\ L_A^+(u)], \\ L_A(u)\rangle \end{array} \right\}$, *the IVFFS is* $\left[ \begin{array}{c} [E_A^-(u), \\ E_A^+(u)], \\ [L_A^-(u), \\ L_A^+(u)] \end{array} \right]$ *and the FFS is* $[E_A(u), L_A(u)]$*, IVFFS represent the MED and FFS presented the NOMED, and* $\left[ \begin{array}{c} [E_A^-(u), E_A^+(u)], \\ [L_A^-(u), L_A^+(u)] \end{array} \right] \in [0,1]$, $[E_A(u), L_A(u)] \in [0,1]$*. The IVFFS and FFS A is said to be CFFN.*

**Definition 2.** *[37] Let* $a_1 = \left\{ \begin{array}{c} \langle [H_1^-, H_1^+], H_1\rangle, \\ \langle [R_1^-, R_1^+], R_1\rangle \end{array} \right\}$ *and* $a_2 = \left\{ \begin{array}{c} \langle [H_2^-, H_2^+], H_2\rangle, \\ \langle [R_2^-, R_2^+], R_2\rangle \end{array} \right\}$ *be two CFEFNs and* $\lambda > 0$*, then*

$$a_1 \oplus a_2 = \left[ \begin{array}{c} \left\langle \left[ \sqrt[3]{\frac{(H_1^-)^3+(H_2^-)^3}{1+(H_1^-)^3(H_2^-)^3}}, \sqrt[3]{\frac{(H_1^+)^3+(H_2^+)^3}{1-(H_1^+)^3(H_2^+)^3}} \right], \frac{H_1H_2}{\sqrt[3]{1+(1-H_1)^3(1-H_2)^3}} \right\rangle, \\ \left\langle \left[ \sqrt[3]{\frac{(R_1^-)^3+(R_2^-)^3}{1+(R_1^-)^3(R_2^-)^3}}, \sqrt[3]{\frac{(R_1^+)^3+(R_2^+)^3}{1-(R_1^+)^3(R_2^+)^3}} \right], \frac{R_1R_2}{\sqrt[3]{1+(1-R_1)^3(1-R_2)^3}} \right\rangle \end{array} \right];$$

$$a_1 \otimes a_2 = \left[ \begin{array}{c} \left\langle \begin{array}{c} \left[ \frac{H_1^-H_2^-}{\sqrt[3]{1+(1-H_1^-)^3(1-H_2^-)^3}}, \frac{H_1^+H_2^+}{\sqrt[3]{1+(1-H_1^+)^3(1-H_2^+)^3}} \right], \\ \sqrt[3]{\frac{(H_1)^3+(H_2)^3}{1+(H_1)^3(H_2)^3}} \end{array} \right\rangle, \\ \left\langle \begin{array}{c} \left[ \frac{R_1^-R_2^-}{\sqrt[3]{1+(1-R_1^-)^3(1-R_2^-)^3}}, \frac{R_1^+R_2^+}{\sqrt[3]{1+(1-R_1^+)^3(1-R_2^+)^3}} \right], \\ \sqrt[3]{\frac{(R_1)^3+(R_2)^3}{1+(R_1)^3(R_2)^3}} \end{array} \right\rangle \end{array} \right];$$

$$\lambda a_1 = \left[ \begin{array}{c} \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{(1+H_1^-)^3)^\lambda-(1-H_1^-)^3)^\lambda}{(1+H_1^-)^3)^\lambda+(1-H_1^-)^3)^\lambda}}, \sqrt[3]{\frac{(1+H_1^+)^3)^\lambda-(1-H_1^+)^3)^\lambda}{(1+H_1^+)^3)^\lambda+(1-H_1^+)^3)^\lambda}} \right], \\ \frac{\sqrt[3]{2}(H_1)^\lambda}{\sqrt[3]{(2-H_1)^3)^\lambda+(H_1)^3)^\lambda}} \end{array} \right\rangle, \\ \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{(1+R_1^-)^3)^\lambda-(1-R_1^-)^3)^\lambda}{(1+R_1^-)^3)^\lambda+(1-R_1^-)^3)^\lambda}}, \sqrt[3]{\frac{(1+R_1^+)^3)^\lambda-(1-R_1^+)^3)^\lambda}{(1+R_1^+)^3)^\lambda+(1-R_1^+)^3)^\lambda}} \right], \\ \frac{\sqrt[3]{2}(R_1)^\lambda}{\sqrt[3]{(2-R_1)^3)^\lambda+(R_1)^3)^\lambda}} \end{array} \right\rangle \end{array} \right];$$

$$a_1^\lambda = \left[ \begin{array}{c} \left\langle \begin{array}{c} \left[ \frac{\sqrt[3]{\lambda}(H_1^-)^\lambda}{\sqrt[3]{((2-H_1^-)^3)^\lambda+((H_1^-)^3)^\lambda}}, \frac{\sqrt[3]{\lambda}(H_1^+)^\lambda}{\sqrt[3]{((2-H_1^+)^3)^\lambda+((H_1^+)^3)^\lambda}} \right], \\ \sqrt[3]{\frac{((1+H_1)^3)^\lambda-((1-H_1)^3)^\lambda}{((1+H_1)^3)^\lambda+((1-H_1)^3)^\lambda}} \end{array} \right\rangle, \\ \left\langle \begin{array}{c} \left[ \frac{\sqrt[3]{\lambda}(R_1^-)^\lambda}{\sqrt[3]{((2-R_1^-)^3)^\lambda+((R_1^-)^3)^\lambda}}, \frac{\sqrt[3]{\lambda}(R_1^+)^\lambda}{\sqrt[3]{((2-R_1^+)^3)^\lambda+((R_1^+)^3)^\lambda}} \right], \\ \sqrt[3]{\frac{((1+R_1)^3)^\lambda-((1-R_1)^3)^\lambda}{((1+R_1)^3)^\lambda+((1-R_1)^3)^\lambda}} \end{array} \right\rangle \end{array} \right]$$

**Definition 3.** *[37] The CFFNs are* $a = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$, *then the score function* $\delta$ *is define as:*$\delta = \frac{\left\{[(H^-)^3+(H^{-+})^3-(H)^3][(R^-)^3+(R^{-+})^3-(R)^3]\right\}}{6}$.

**Definition 4.** *[37] The CFFNs are* $a = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$, *then the accuracy function* $\Gamma$ *is define as:*$\Gamma = \frac{\left\{[(H^-)^3+(H^{-+})^3+(H)^3][(R^-)^3+(R^{-+})^3+(R)^3]\right\}}{6}$..

## 3. Einstein-based aggregating operator for CFFNs

In this section, CFEFWA, CFEFOWA, CFEFHWA operators are provided.

### 3.1. CFEFWA operator

**Definition 5.** *The family of CFFNs are* $c_j = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ *and the weight vector is* $G = (G_1, G_2, ..., G_n)^T$ *with* $G_j \in [0, 1]$ *and* $\sum\limits_{j=1}^{n} G_j = 1$. *Then* $CFEFWA(c_1, c_2, ..., c_n) = \bigoplus\limits_{j=1}^{n} G_j c_j$ *is said CFEFWA operator.*

**Theorem 1.** *The collection of CFFNs are* $a_j = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ *and the weight vector is* $L = (L_1, L_2, ..., L_n)^T$ *with* $L_j \in [0, 1]$ *and* $\sum\limits_{j=1}^{n} L_j = 1$. *Then it is said CFEFWA operator and* $CFEFWA(a_1, a_2, ..., a_n) =$

$$\left[ \begin{array}{c} \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+H_j^-)^3)^L - \prod\limits_{j=1}^{n}(1-H_j^-)^3)^L}{\prod\limits_{j=1}^{n}((1+H_j^-)^3)^L + \prod\limits_{j=1}^{n}((1-H_j^-)^3)^L}}, \sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+H_j^+)^3)^L - \prod\limits_{j=1}^{n}((1-H_j^+)^3)^L}{\prod\limits_{j=1}^{n}((1+H_j^+)^3)^L + \prod\limits_{j=1}^{n}((1-H_j^+)^3)^L}} \right], \\ \frac{\sqrt[3]{2}\prod\limits_{j=1}^{n}(H_j)^L}{\sqrt[3]{\prod\limits_{j=1}^{n}((2-H_j)^3)^L + \prod\limits_{j=1}^{n}((H_j)^3)^L}} \end{array} \right\rangle, \\ \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+R_j^-)^3)^L - \prod\limits_{j=1}^{n}((1-R_j^-)^3)^L}{\prod\limits_{j=1}^{n}((1+R_j^-)^3)^L + \prod\limits_{j=1}^{n}(1-R_j^-)^3)^L}}, \sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+R_j^+)^3)^L - \prod\limits_{j=1}^{n}((1-R_j^+)^3)^L}{\prod\limits_{j=1}^{n}((1+R_j^+)^3)^L + \prod\limits_{j=1}^{n}((1-R_j^+)^3)^L}} \right], \\ \frac{\sqrt[3]{2}\prod\limits_{j=1}^{n}(R_j)^L}{\sqrt[3]{\prod\limits_{j=1}^{n}((2-R_j)^3)^L + \prod\limits_{j=1}^{n}((R_j)^3)^L}} \end{array} \right\rangle \end{array} \right]$$

*Proof.* Since $n$ is true and $n=1$

$$L_1a_1=\begin{bmatrix}\left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+H_1^-)^3)^{L_1}-(1-H_1^-)^3)^{L_1}}{((1+H_1^-)^3)^{L_1}+(1-H_1^-)^3)^{L_1}}},\sqrt[3]{\frac{((1+H_1^+)^3)^{L_1}-((1-H_1^+)^3)^{L_1}}{((1+H_1^+)^3)^{L_1}+((1-H_1^+)^3)^{L_1}}}\right],\\ \frac{\sqrt[3]{2}(H_1)^{L_1}}{\sqrt[3]{(2-H_1)^3)^{L_1}+(H_1)^3)^{L_1}}}\end{matrix}\right\rangle,\\ \left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+R_1^-)^3)^{L_1}-(1-R_1^-)^3)^{L_1}}{((1+R_1^-)^3)^{L_1}+(1-R_1^-)^3)^{L_1}}},\sqrt[3]{\frac{((1+R_1^+)^3)^{L_1}-((1-R_1^+)^3)^{L_1}}{((1+R_1^+)^3)^{L_1}+((1-R_1^+)^3)^{L_1}}}\right],\\ \frac{\sqrt[3]{2}(R_1)^{L_1}}{\sqrt[3]{((2-R_1)^3)^{L_1}+((R_1)^3)^{L_1}}}\end{matrix}\right\rangle\end{bmatrix}$$

$$L_2a_2=\begin{bmatrix}\left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+H_2^-)^3)^{L_2}-(1-H_2^-)^3)^{L_2}}{((1+H_2^-)^3)^{L_2}+(1-H_2^-)^3)^{L_2}}},\sqrt[3]{\frac{((1+H_2^+)^3)^{L_2}-((1-H_2^+)^3)^{L_2}}{((1+H_2^+)^3)^{L_2}+((1-H_2^+)^3)^{L_2}}}\right],\\ \frac{\sqrt[3]{2}(H_2)^{L_2}}{\sqrt[3]{(2-H_2)^3)^{L_2}+(H_2)^3)^{L_2}}}\end{matrix}\right\rangle,\\ \left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+R_2^-)^3)^{L_2}-(1-R_2^-)^3)^{L_2}}{((1+R_2^-)^3)^{L_2}+(1-R_2^-)^3)^{L_2}}},\sqrt[3]{\frac{((1+R_2^+)^3)^{L_2}-((1-R_2^+)^3)^{L_2}}{((1+R_2^+)^3)^{L_2}+((1-R_2^+)^3)^{L_2}}}\right],\\ \frac{\sqrt[3]{2}(R_2)^{L_2}}{\sqrt[3]{((2-R_2)^3)^{L_2}+((R_2)^3)^{L_2}}}\end{matrix}\right\rangle\end{bmatrix}$$

$$L_1a_1\oplus L_2a_2=\begin{bmatrix}\left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+H_1^-)^3)^{L_1}-(1-H_1^-)^3)^{L_1}}{((1+H_1^-)^3)^{L_1}+(1-H_1^-)^3)^{L_1}}},\sqrt[3]{\frac{((1+H_1^+)^3)^{L_1}-((1-H_1^+)^3)^{L_1}}{((1+H_1^+)^3)^{L_1}+((1-H_1^+)^3)^{L_1}}}\right],\\ \frac{\sqrt[3]{2}(H_1)^{L_1}}{\sqrt[3]{(2-H_1)^3)^{L_1}+(H_1)^3)^{L_1}}}\end{matrix}\right\rangle,\\ \left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+R_1^-)^3)^{L_1}-(1-R_1^-)^3)^{L_1}}{((1+R_1^-)^3)^{L_1}+(1-R_1^-)^3)^{L_1}}},\sqrt[3]{\frac{((1+R_1^+)^3)^{L_1}-((1-R_1^+)^3)^{L_1}}{((1+R_1^+)^3)^{L_1}+((1-R_1^+)^3)^{L_1}}}\right],\\ \frac{\sqrt[3]{2}(R_1)^{L_1}}{\sqrt[3]{((2-R_1)^3)^{L_1}+((R_1)^3)^{L_1}}}\end{matrix}\right\rangle\end{bmatrix}\oplus$$

$$\begin{bmatrix}\left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+H_2^-)^3)^{L_2}-(1-H_2^-)^3)^{L_2}}{((1+H_2^-)^3)^{L_2}+(1-H_2^-)^3)^{L_2}}},\sqrt[3]{\frac{((1+H_2^+)^3)^{L_2}-((1-H_2^+)^3)^{L_2}}{((1+H_2^+)^3)^{L_2}+((1-H_2^+)^3)^{L_2}}}\right],\\ \frac{\sqrt[3]{2}(H_2)^{L_2}}{\sqrt[3]{(2-H_2)^3)^{L_2}+(H_2)^3)^{L_2}}}\end{matrix}\right\rangle,\\ \left\langle \begin{matrix}\left[\sqrt[3]{\frac{((1+R_2^-)^3)^{L_2}-(1-R_2^-)^3)^{L_2}}{((1+R_2^-)^3)^{L_2}+(1-R_2^-)^3)^{L_2}}},\sqrt[3]{\frac{((1+R_2^+)^3)^{L_2}-((1-R_2^+)^3)^{L_2}}{((1+R_2^+)^3)^{L_2}+((1-R_2^+)^3)^{L_2}}}\right],\\ \frac{\sqrt[3]{2}(R_2)^{L_2}}{\sqrt[3]{((2-R_2)^3)^{L_2}+((R_2)^3)^{L_2}}}\end{matrix}\right\rangle\end{bmatrix}$$

Since $n=k$

$\text{CFEFWA}(a_1,a_2,...,a_n)=$

$$\left[\begin{array}{c}\left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod_{j=1}^{k}(1+H_j^{-})^3)^L-\prod_{j=1}^{k}(1-H_j^{-})^3)^L}{\prod_{j=1}^{k}(1+H_j^{-})^3)^L+\prod_{j=1}^{k}(1-H_j^{-})^3)^L}},\sqrt[3]{\frac{\prod_{j=1}^{k}(1+H_j^{+})^3)^L-\prod_{j=1}^{k}(1-H_j^{+})^3)^L}{\prod_{j=1}^{k}(1+H_j^{+})^3)^L+\prod_{j=1}^{k}(1-H_j^{+})^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod_{j=1}^{k}(H_j)^L}{\sqrt[3]{\prod_{j=1}^{k}(2-H_j)^3)^L+\prod_{j=1}^{k}(H_j)^3)^L}}\end{array}\right\rangle,\\ \left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod_{j=1}^{k}(1+R_j^{-})^3)^L-\prod_{j=1}^{k}(1-R_j^{-})^3)^L}{\prod_{j=1}^{k}(1+R_j^{-})^3)^L+\prod_{j=1}^{k}(1-R_j^{-})^3)^L}},\sqrt[3]{\frac{\prod_{j=1}^{k}(1+R_j^{+})^3)^L-\prod_{j=1}^{k}(1-R_j^{+})^3)^L}{\prod_{j=1}^{k}(1+R_j^{+})^3)^L+\prod_{j=1}^{k}(1-R_j^{+})^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod_{j=1}^{k}(R_j)^L}{\sqrt[3]{\prod_{j=1}^{k}(2-R_j)^3)^L+\prod_{j=1}^{k}(R_j)^3)^L}}\end{array}\right\rangle\end{array}\right]$$

Since $n = k + 1$

$\mathrm{CFEFWA}(a_1, a_2, ..., a_n) =$

$$\left[\begin{array}{c}\left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod_{j=1}^{k+1}(1+H_j^{-})^3)^L-\prod_{j=1}^{k+1}(1-H_j^{-})^3)^L}{\prod_{j=1}^{k+1}(1+H_j^{-})^3)^L+\prod_{j=1}^{k+1}(1-H_j^{-})^3)^L}},\sqrt[3]{\frac{\prod_{j=1}^{k+1}(1+H_j^{+})^3)^L-\prod_{j=1}^{k+1}(1-H_j^{+})^3)^L}{\prod_{j=1}^{k+1}(1+H_j^{+})^3)^L+\prod_{j=1}^{k+1}(1-H_j^{+})^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod_{j=1}^{k+1}(H_j)^L}{\sqrt[3]{\prod_{j=1}^{k+1}(2-H_j)^3)^L+\prod_{j=1}^{k+1}(H_j)^3)^L}}\end{array}\right\rangle,\\ \left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod_{j=1}^{k+1}(1+R_j^{-})^3)^L-\prod_{j=1}^{k+1}(1-R_j^{-})^3)^L}{\prod_{j=1}^{k+1}(1+R_j^{-})^3)^L+\prod_{j=1}^{k+1}(1-R_j^{-})^3)^L}},\sqrt[3]{\frac{\prod_{j=1}^{k+1}(1+R_j^{+})^3)^L-\prod_{j=1}^{k+1}(1-R_j^{+})^3)^L}{\prod_{j=1}^{k+1}(1+R_j^{+})^3)^L+\prod_{j=1}^{k+1}(1-R_j^{+})^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod_{j=1}^{k+1}(R_j)^L}{\sqrt[3]{\prod_{j=1}^{k+1}(2-R_j)^3)^L+\prod_{j=1}^{k+1}(R_j)^3)^L}}\end{array}\right\rangle\end{array}\right]$$

**Theorem 2.** ***(Idempotency):****If* $\widetilde{ZV} = \left\{\begin{array}{c}\langle[H^-, H^+], H\rangle,\\ \langle[R^-, R^+], R\rangle\end{array}\right\}$ *for all* $j = 1, 2, 3, ..., n,$

*then* $CFEFWA(ZV, ZV, ZV, ..., ZV) = ZV$.

*Proof.* $Zv = ZV$ are equal to

$$\left[\begin{array}{c}\left\langle \begin{array}{c}\left[\sqrt[3]{\frac{\left((1+H_j^-)^3\right)^{\sum_{j=1}^{n} L_j}-\left((1+H_j^-)^3\right)^{\sum_{j=1}^{n} L_j}}{\left((1+H_j^-)^3\right)^{\sum_{j=1}^{n} L_j}+\left((1+H_j^-)^3\right)^{\sum_{j=1}^{n} L_j}}}, \sqrt[3]{\frac{\left((1+H_j^+)^3\right)^{\sum_{j=1}^{n} L_j}-\left((1+H_j^+)^3\right)^{\sum_{j=1}^{n} L_j}}{\left((1+H_j^+)^3\right)^{\sum_{j=1}^{n} L_j}+\left((1+H_j^+)^3\right)^{\sum_{j=1}^{n} L_j}}}\right], \\ \frac{\sqrt[3]{2}\left((H_j)^3\right)^{\sum_{j=1}^{n} L_j}}{\sqrt[3]{\left(2-H_j^3\right)^{\sum_{j=1}^{n} L_j}+\left(H_j^3\right)^{\sum_{j=1}^{n} L_j}}}\end{array}\right\rangle, \\ \left\langle \begin{array}{c}\left[\sqrt[3]{\frac{\left((1+R_j^-)^3\right)^{\sum_{j=1}^{n} L_j}-\left((1+R_j^-)^3\right)^{\sum_{j=1}^{n} L_j}}{\left((1+R_j^-)^3\right)^{\sum_{j=1}^{n} L_j}+\left((1+R_j^-)^3\right)^{\sum_{j=1}^{n} L_j}}}, \sqrt[3]{\frac{\left((1+R_j^+)^3\right)^{\sum_{j=1}^{n} L_j}-\left((1+R_j^+)^3\right)^{\sum_{j=1}^{n} L_j}}{\left((1+R_j^+)^3\right)^{\sum_{j=1}^{n} L_j}+\left((1+R_j^+)^3\right)^{\sum_{j=1}^{n} L_j}}}\right], \\ \frac{\sqrt[3]{2}\left((R_j)^3\right)^{\sum_{j=1}^{n} L_j}}{\sqrt[3]{\left(2-R_j^3\right)^{\sum_{j=1}^{n} L_j}+\left(R_j^3\right)^{\sum_{j=1}^{n} L_j}}}\end{array}\right\rangle\end{array}\right]$$

$$\left[\begin{array}{c}\left\langle \begin{array}{c}\left[\sqrt[3]{\frac{\left((1+H_j^-)^3\right)-\left((1+H_j^-)^3\right)}{\left((1+H_j^-)^3\right)+\left((1+H_j^-)^3\right)}}, \sqrt[3]{\frac{\left((1+H_j^+)^3\right)-\left((1+H_j^+)^3\right)}{\left((1+H_j^+)^3\right)+\left((1+H_j^+)^3\right)}}\right], \\ \frac{\sqrt[3]{2}\left((H_j)^3\right)}{\sqrt[3]{\left(2-H_j^3\right)+\left(H_j^3\right)}}\end{array}\right\rangle, \\ \left\langle \begin{array}{c}\left[\sqrt[3]{\frac{\left((1+R_j^-)^3\right)-\left((1+R_j^-)^3\right)}{\left((1+R_j^-)^3\right)+\left((1+R_j^-)^3\right)}}, \sqrt[3]{\frac{\left((1+R_j^+)^3\right)-\left((1+R_j^+)^3\right)}{\left((1+R_j^+)^3\right)+\left((1+R_j^+)^3\right)}}\right], \\ \frac{\sqrt[3]{2}\left((R_j)^3\right)}{\sqrt[3]{\left(2-R_j^3\right)+\left(R_j^3\right)}}\end{array}\right\rangle\end{array}\right]$$

**Theorem 3.** ***(Boundedness):****If* $C^- = min(d_1, d_2, ..., d_n)$, $C^+ = \max(d_1, d_2, ..., d_n)$, *then* $C^- \leq CFEFWA(d_1, d_2, ..., d_n) \leq C^+$.

## 3.2. CFEFOWA operator

**Definition 6.** *The gathering of CFFNs are* $c_j = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ *and the weight vector is* $G = (G_1, G_2, ..., G_n)^T$ *with* $G_j \in [0,1]$ *and* $\sum_{j=1}^{n} G_j = 1$*. Then* $CFEFOWA(c_1, c_2, ..., c_n) = \bigoplus_{j=1}^{n} G_j c_j$ *is said CFEFOWA operator.*

**Theorem 4.** *The collection of CFFNs are* $a_j = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ *and the weight vector is* $L = (L_1, L_2, ..., L_n)^T$ *with* $L_j \in [0,1]$ *and* $\sum_{j=1}^{n} L_j = 1$*. Then it is said CFEFOWA operator and* $CFEFOWA(a_1, a_2, ..., a_n) =$

$$\left[ \begin{array}{c} \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{\prod_{j=1}^{n}((1+H_j^-)^3)^L - \prod_{j=1}^{n}(1-H_j^-)^3)^L}{\prod_{j=1}^{n}((1+H_j^-)^3)^L + \prod_{j=1}^{n}((1-H_j^-)^3)^L}}, \sqrt[3]{\frac{\prod_{j=1}^{n}((1+H_j^+)^3)^L - \prod_{j=1}^{n}((1-H_j^+)^3)^L}{\prod_{j=1}^{n}((1+H_j^+)^3)^L + \prod_{j=1}^{n}((1-H_j^+)^3)^L}} \right], \\ \frac{\sqrt[3]{2}\prod_{j=1}^{n}(H_j)^L}{\sqrt[3]{\prod_{j=1}^{n}((2-H_j)^3)^L + \prod_{j=1}^{n}((H_j)^3)^L}} \end{array} \right\rangle, \\ \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{\prod_{j=1}^{n}((1+R_j^-)^3)^L - \prod_{j=1}^{n}((1-R_j^-)^3)^L}{\prod_{j=1}^{n}((1+R_j^-)^3)^L + \prod_{j=1}^{n}(1-R_j^-)^3)^L}}, \sqrt[3]{\frac{\prod_{j=1}^{n}((1+R_j^+)^3)^L - \prod_{j=1}^{n}((1-R_j^+)^3)^L}{\prod_{j=1}^{n}((1+R_j^+)^3)^L + \prod_{j=1}^{n}((1-R_j^+)^3)^L}} \right], \\ \frac{\sqrt[3]{2}\prod_{j=1}^{n}(R_j)^L}{\sqrt[3]{\prod_{j=1}^{n}((2-R_j)^3)^L + \prod_{j=1}^{n}((R_j)^3)^L}} \end{array} \right\rangle \end{array} \right]$$

**Theorem 5.** ***(Idempotency):****If* $\widetilde{Y} = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ *for all* $k = 1, 2, 3, ..., n$*, then* $CFEFOWA(Y, Y, Y, ..., Y) = Y$*.*

**Theorem 6.** ***(Boundedness):****If* $Z^- = min(b_1, b_2, ..., b_n)$*,* $Z^+ = \max(b_1, b_2, ..., b_n)$*, then* $Z^- \leq CFEFOWA(b_1, b_2, ..., b_n) \leq Z^+$*.*

## 3.3. CFEFHWA operator

**Definition 7.** *The gathering of CFFNs are* $z_j = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ *and the weight vector is* $G = (G_1, G_2, ..., G_n)^T$ *with* $G_j \in [0,1]$ *and* $\sum_{j=1}^{n} G_j = 1$ *and associated vector is*

*$G = (G_1, G_2, ..., G_n)^T$ with $G_j \in [0,1]$ and $\sum_{j=1}^{n} G_j = 1$. Then CFEFHWA$(z_1, z_2, ..., z_n) = \bigoplus_{j=1}^{n} G_j z_j$ is said CFEFHWA operator.*

**Theorem 7.** *The collection of CFFNs are $a_j = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ and the weight vector is $L = (L_1, L_2, ..., L_n)^T$ with $L_j \in [0,1]$ and $\sum_{j=1}^{n} L_j = 1$. Then it is said CFEFHWA operator and CFEFHWA$(a_1, a_2, ..., a_n) =$*

$$\left[ \begin{array}{c} \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{\prod_{j=1}^{n}((1+H_j^-)^3)^L - \prod_{j=1}^{n}(1-H_j^-)^3)^L}{\prod_{j=1}^{n}((1+H_j^-)^3)^L + \prod_{j=1}^{n}((1-H_j^-)^3)^L}}, \sqrt[3]{\frac{\prod_{j=1}^{n}((1+H_j^+)^3)^L - \prod_{j=1}^{n}((1-H_j^+)^3)^L}{\prod_{j=1}^{n}((1+H_j^+)^3)^L + \prod_{j=1}^{n}((1-H_j^+)^3)^L}} \right], \\ \frac{\sqrt[3]{2}\prod_{j=1}^{n}(H_j)^L}{\sqrt[3]{\prod_{j=1}^{n}((2-H_j)^3)^L + \prod_{j=1}^{n}((H_j)^3)^L}} \end{array} \right\rangle, \\ \left\langle \begin{array}{c} \left[ \sqrt[3]{\frac{\prod_{j=1}^{n}((1+R_j^-)^3)^L - \prod_{j=1}^{n}((1-R_j^-)^3)^L}{\prod_{j=1}^{n}((1+R_j^-)^3)^L + \prod_{j=1}^{n}(1-R_j^-)^3)^L}}, \sqrt[3]{\frac{\prod_{j=1}^{n}((1+R_j^+)^3)^L - \prod_{j=1}^{n}((1-R_j^+)^3)^L}{\prod_{j=1}^{n}((1+R_j^+)^3)^L + \prod_{j=1}^{n}((1-R_j^+)^3)^L}} \right], \\ \frac{\sqrt[3]{2}\prod_{j=1}^{n}(R_j)^L}{\sqrt[3]{\prod_{j=1}^{n}((2-R_j)^3)^L + \prod_{j=1}^{n}((R_j)^3)^L}} \end{array} \right\rangle \end{array} \right]$$

**Theorem 8.** ***(Idempotency):****If $\widetilde{c} = \left\{ \begin{array}{c} \langle [H^-, H^+], H \rangle, \\ \langle [R^-, R^+], R \rangle \end{array} \right\}$ for all $k = 1, 2, 3, ..., n$, then CFEFHWA$(Y, Y, Y, ..., Y) = Y$.*

**Theorem 9.** ***(Boundedness):****If $F^- = min(d_1, d_2, ..., d_n)$, $F^+ = \max(d_1, d_2, ..., d_n)$, then $F^- \leq$CFEFHWA$(d_1, d_2, ..., d_n) \leq F^+$.*

## 4. MCDM technique on CFF

Step 1:Describe the CFF decision matrix
Step 2:Describe the CFEFWA operator and $L = (L_1, L_2, ..., L_n)$.
CFEFWA$(d_1, d_2, ..., d_n) \ =$

$$\left[\begin{array}{c}\left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+H_j^-)^3)^L-\prod\limits_{j=1}^{n}(1-H_j^-)^3)^L}{\prod\limits_{j=1}^{n}((1+H_j^-)^3)^L+\prod\limits_{j=1}^{n}((1-H_j^-)^3)^L}},\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+H_j^+)^3)^L-\prod\limits_{j=1}^{n}((1-H_j^+)^3)^L}{\prod\limits_{j=1}^{n}((1+H_j^+)^3)^L+\prod\limits_{j=1}^{n}((1-H_j^+)^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod\limits_{j=1}^{n}(H_j)^L}{\sqrt[3]{\prod\limits_{j=1}^{n}((2-H_j)^3)^L+\prod\limits_{j=1}^{n}((H_j)^3)^L}}\end{array}\right\rangle,\\ \left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+R_j^-)^3)^L-\prod\limits_{j=1}^{n}((1-R_j^-)^3)^L}{\prod\limits_{j=1}^{n}((1+R_j^-)^3)^L+\prod\limits_{j=1}^{n}(1-R_j^-)^3)^L}},\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+R_j^+)^3)^L-\prod\limits_{j=1}^{n}((1-R_j^+)^3)^L}{\prod\limits_{j=1}^{n}((1+R_j^+)^3)^L+\prod\limits_{j=1}^{n}((1-R_j^+)^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod\limits_{j=1}^{n}(R_j)^L}{\sqrt[3]{\prod\limits_{j=1}^{n}((2-R_j)^3)^L+\prod\limits_{j=1}^{n}((R_j)^3)^L}}\end{array}\right\rangle\end{array}\right]$$

Step 3:Describe the CFEFWA operator and $L=(L_1,L_2,...,L_n)$.

$\mathrm{CFEFWA}(d_1,d_2,...,d_n)\ =$

$$\left[\begin{array}{c}\left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+H_j^-)^3)^L-\prod\limits_{j=1}^{n}(1-H_j^-)^3)^L}{\prod\limits_{j=1}^{n}((1+H_j^-)^3)^L+\prod\limits_{j=1}^{n}((1-H_j^-)^3)^L}},\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+H_j^+)^3)^L-\prod\limits_{j=1}^{n}((1-H_j^+)^3)^L}{\prod\limits_{j=1}^{n}((1+H_j^+)^3)^L+\prod\limits_{j=1}^{n}((1-H_j^+)^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod\limits_{j=1}^{n}(H_j)^L}{\sqrt[3]{\prod\limits_{j=1}^{n}((2-H_j)^3)^L+\prod\limits_{j=1}^{n}((H_j)^3)^L}}\end{array}\right\rangle,\\ \left\langle\begin{array}{c}\left[\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+R_j^-)^3)^L-\prod\limits_{j=1}^{n}((1-R_j^-)^3)^L}{\prod\limits_{j=1}^{n}((1+R_j^-)^3)^L+\prod\limits_{j=1}^{n}(1-R_j^-)^3)^L}},\sqrt[3]{\frac{\prod\limits_{j=1}^{n}((1+R_j^+)^3)^L-\prod\limits_{j=1}^{n}((1-R_j^+)^3)^L}{\prod\limits_{j=1}^{n}((1+R_j^+)^3)^L+\prod\limits_{j=1}^{n}((1-R_j^+)^3)^L}}\right],\\ \frac{\sqrt[3]{2}\prod\limits_{j=1}^{n}(R_j)^L}{\sqrt[3]{\prod\limits_{j=1}^{n}((2-R_j)^3)^L+\prod\limits_{j=1}^{n}((R_j)^3)^L}}\end{array}\right\rangle\end{array}\right]$$

Step 4:Provide the score function.

Step 5:Find the ordering.

## 5. Case study

In this section, four modernizer middles have been painstaking at the twitch opinions, which are full by A opinion and finally second hand by D opinion. Respectively opinion has been examined by their conservation antiquity and recent peak weight opinion. Modernizer conservation antiquity and recent peak load opinion can exemplify the greatest of their makings. This investigation efforts to generate a distinct peep to identify opinions, which are essential for decisive the site of EV charging positions, that container help to shape a joining with the network strategy. In the next units, the future solution for the decisive organization of EV charging positions will be expounded with instances. Ankara municipal electricity network is unique in the actual cases to education, representative significant limits, when the network must be prepared to stock electric vehicles and loadings. As validated in the works, the groups of charging positions coldness can alteration excellence of control, service, cost, and EVs skill receipt ratio concerning memberships of civilization. numerous substances, such as the network substructure and current Evs' successful round, strongminded the variety of charging positions. Moreover, if the network does not use charging positions, some sites should be gritty by additional stipulations. These can be diverse in each network and be contingent on the network's disorder. According to the hitherto-stated data and Ankara metropolitan electricity substructure, the distance of network stations and power volume are critical opinions in the organization of the electric vehicle charge position theme. A city's transport routes are dissimilar from the way of the power broadcast network and each site has exact power volume particulars. In the first step, creators must choose sites like opinions or seats, which have the lowermost coldness to electricity stations and are appropriate for transport schemes. The goalmouth is to degree energy and duty for supply and request. For instance, two dissimilar opinions in Ankara have been measured by the A and B modifier middles. Both are on the chief and packed roads, but the A modernizer middle's disorder brands its additional working than the B modifier midpoint. This is because the modernizer midpoint is adjacent to the center where the main transport stations, such as buses and Pullmans, are contained. Whereas 1-2 km from canter, metro, stations, and location of modifier A and B have numerous allowed seats, space, schools, hospitals, and ministries. It appears that in this part, many vehicles are stationary, and this can be potentially beneficial. In contrast, the B transformer midpoint does not have personal choices, and because of this, the B modernizer midpoint misplaces its importance in shaping a charging position. Site EV charge position opinions must be branded by sensible detachments such as 30, 35, 40, 45, and 50 km, contingent on part and substructure disorder. In the stated circumstance, the network situations were analysed, based on the modernizer rank, even though there remained no pre-defined storing midpoint or prepared charge position. This designates that modernizer stipulations could deliver potential data to assess the probability of charging positions [50].

## 5.1. Numerical example

EV charging can be classified into four main categories: slow, fast, rapid, and ultra-quick. These represent the power outputs and, thus, charging speeds that are possible to charge an electric vehicle (EV). FGNEX 60-160kW DC Fast Charger Fast charging of pure electric vehicles is the main use for the DC charging pile, an isolated DC charging pile focused on product safety performance. With an IP 55 protection grade and an environmental protection design, these charging heaps are built for outdoor floor types and include corrosion-proof, waterproof, and dust-proof capabilities. The product's modular design integrates the car connector, human-machine interface, charger, communication, and billing elements into a single cabinet, making it easy to install, troubleshoot, and maintain. The items may be used in large parking lots, residential areas, malls, hospitals, transfer stations, airports, docks, parks, and other places. FGNEX 60-180kW Multi-Standard DC Fast Charger Wuxi Fgnex Technology Co., Ltd. developed a particular kind of DC EV charging station known as an EV Charging Station to increase the safety of its products. To provide the maximum charging power from any charging station, this charging system solution's flexible combination and free power distribution characteristics can be adjusted to the needs of the customer. The product's modular design idea combined the vehicle connector, human-machine interface, charger, communication, and billing parts into a single cabinet to enable straightforward installation, debugging, operation, and maintenance, among other benefits. The items may be used in large parking lots, residential areas, malls, hospitals, transfer stations, airports, docks, parks, and other places. FGNEX 300-600kW Split Type Pantograph System With a focus on product safety, Wuxi Fgnex Technology Co., Ltd. developed the DC split pantograph HK-300-BE1. Mostly, all-electric bus quick charging is done with it. This range of outdoor split-type goods has an IP54 protection certification and is designed to be waterproof, dustproof, anti-corrosion, and environmentally friendly. This pantograph has combined the charging interface, location, communication, invoicing, monitoring, and other features into a single cabinet by using a modular design approach. It could be used by the bus station or a large parking lot, for example. FGNEX 300kw Split Type Fan Cooling DC Charging System To increase the safety of its products, Wuxi Fgnex Technology developed a particular kind of DC EV charging station known as an EV Charging Station. This charging system solution's free power distribution and flexible combination features allow it to be customized to the needs of the user to provide the maximum charging power possible from any type of charging station. The product's modular design idea incorporated the vehicle connector, charger, human-machine interface, communication, and billing sections into one cabinet to promote easy installation and debugging, simple operation and maintenance. The goods may be used in airports, docks, parks, shopping centers, hospitals, hospitals, large parking lots, and other venues, quick, ultra-rapid, fast, and swift.

Step 1:Explain Tables 1 and 2 of the CFF Decision Matrix..

CFF decision matrix table 1.

| | $S$ | $F$ | $R$ | $U$ |
|---|---|---|---|---|
| $PS_1$ | $\left[\begin{array}{c}\langle [0.1, 0.3], 0.2 \rangle, \\ \langle [0.2, 0.4], 0.3 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.02, 0.05], 0.04 \rangle, \\ \langle [0.1, 0.3], 0.1 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.11, 0.13], 0.1 \rangle, \\ \langle [0.21, 0.34], 0.4 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.01, 0.14], 0.2 \rangle, \\ \langle [0.31, 0.37], 0.6 \rangle\end{array}\right]$ |
| $PS_2$ | $\left[\begin{array}{c}\langle [0.02, 0.05], 0.04 \rangle, \\ \langle [0.1, 0.3], 0.1 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.1, 0.3], 0.2 \rangle, \\ \langle [0.2, 0.4], 0.3 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.01, 0.14], 0.2 \rangle, \\ \langle [0.31, 0.37], 0.6 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.11, 0.13], 0.1 \rangle, \\ \langle [0.21, 0.34], 0.4 \rangle\end{array}\right]$ |
| $PS_3$ | $\left[\begin{array}{c}\langle [0.01, 0.14], 0.2 \rangle, \\ \langle [0.31, 0.37], 0.6 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.02, 0.05], 0.04 \rangle, \\ \langle [0.1, 0.3], 0.1 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.1, 0.3], 0.2 \rangle, \\ \langle [0.2, 0.4], 0.3 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.11, 0.13], 0.1 \rangle, \\ \langle [0.21, 0.34], 0.4 \rangle\end{array}\right]$ |
| $PS_4$ | $\left[\begin{array}{c}\langle [0.01, 0.14], 0.2 \rangle, \\ \langle [0.31, 0.37], 0.6 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.11, 0.13], 0.1 \rangle, \\ \langle [0.21, 0.34], 0.4 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.02, 0.05], 0.04 \rangle, \\ \langle [0.1, 0.3], 0.1 \rangle\end{array}\right]$ | $\left[\begin{array}{c}\langle [0.1, 0.3], 0.2 \rangle, \\ \langle [0.2, 0.4], 0.3 \rangle\end{array}\right]$ |

CFF decision matrix table 2.

| | $S$ | $F$ | $R$ | $U$ |
|---|---|---|---|---|
| $PS_1$ | $\left[\left\langle [0.11, 0.13], 0.12 \right\rangle, \left\langle [0.2, 0.4], 0.3 \right\rangle\right]$ | $\left[\left\langle [0.12, 0.15], 0.14 \right\rangle, \left\langle [0.1, 0.3], 0.1 \right\rangle\right]$ | $\left[\left\langle [0.21, 0.23], 0.22 \right\rangle, \left\langle [0.21, 0.34], 0.4 \right\rangle\right]$ | $\left[\left\langle [0.31, 0.34], 0.22 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ |
| $PS_2$ | $\left[\left\langle [0.31, 0.34], 0.22 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ | $\left[\left\langle [0.1, 0.3], 0.2 \right\rangle, \left\langle [0.2, 0.4], 0.3 \right\rangle\right]$ | $\left[\left\langle [0.01, 0.14], 0.2 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ | $\left[\left\langle [0.11, 0.13], 0.1 \right\rangle, \left\langle [0.21, 0.34], 0.4 \right\rangle\right]$ |
| $PS_3$ | $\left[\left\langle [0.01, 0.14], 0.2 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ | $\left[\left\langle [0.02, 0.05], 0.04 \right\rangle, \left\langle [0.1, 0.3], 0.1 \right\rangle\right]$ | $\left[\left\langle [0.31, 0.34], 0.22 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ | $\left[\left\langle [0.11, 0.13], 0.1 \right\rangle, \left\langle [0.21, 0.34], 0.4 \right\rangle\right]$ |
| $PS_4$ | $\left[\left\langle [0.31, 0.34], 0.22 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ | $\left[\left\langle [0.11, 0.13], 0.1 \right\rangle, \left\langle [0.21, 0.34], 0.4 \right\rangle\right]$ | $\left[\left\langle [0.02, 0.05], 0.04 \right\rangle, \left\langle [0.1, 0.3], 0.1 \right\rangle\right]$ | $\left[\left\langle [0.31, 0.34], 0.22 \right\rangle, \left\langle [0.31, 0.37], 0.6 \right\rangle\right]$ |

Step 2:Describe the CFEFWA operator and $\xi = (0.26, 0.21, 0.25, 0.28)$.
CFEFWA operator table 3.

| | $S$ | $F$ | $R$ | $U$ |
|---|---|---|---|---|
| $PS_1$ | $\left[\left\langle [0.1001, 0.1983], 0.1092 \right\rangle, \left\langle [0.2123, 0.4098], 0.3045 \right\rangle\right]$ | $\left[\left\langle [0.1452, 0.1675], 0.1124 \right\rangle, \left\langle [0.1231, 0.3011], 0.1154 \right\rangle\right]$ | $\left[\left\langle [0.2561, 0.2343], 0.2032 \right\rangle, \left\langle [0.2671, 0.3034], 0.0914 \right\rangle\right]$ | $\left[\left\langle [0.3091, 0.3344], 0.2092 \right\rangle, \left\langle [0.3041, 0.3127], 0.6163 \right\rangle\right]$ |
| $PS_2$ | $\left[\left\langle [0.3031, 0.3014], 0.2052 \right\rangle, \left\langle [0.3081, 0.3047], 0.6129 \right\rangle\right]$ | $\left[\left\langle [0.1231, 0.3453], 0.9872 \right\rangle, \left\langle [0.2125, 0.4097], 0.3026 \right\rangle\right]$ | $\left[\left\langle [0.0001, 0.1004], 0.2123 \right\rangle, \left\langle [0.3001, 0.3097], 0.6098 \right\rangle\right]$ | $\left[\left\langle [0.1091, 0.1023], 0.1347 \right\rangle, \left\langle [0.2001, 0.3094], 0.4931 \right\rangle\right]$ |
| $PS_3$ | $\left[\left\langle [0.0131, 0.1134], 0.2359 \right\rangle, \left\langle [0.3001, 0.3037], 0.6124 \right\rangle\right]$ | $\left[\left\langle [0.0212, 0.0556], 0.0411 \right\rangle, \left\langle [0.1034, 0.3012], 0.1104 \right\rangle\right]$ | $\left[\left\langle [0.3051, 0.3084], 0.2082 \right\rangle, \left\langle [0.3121, 0.3097], 0.6912 \right\rangle\right]$ | $\left[\left\langle [0.1091, 0.1973], 0.1123 \right\rangle, \left\langle [0.2091, 0.3344], 0.4654 \right\rangle\right]$ |
| $PS_4$ | $\left[\left\langle [0.3061, 0.3074], 0.2122 \right\rangle, \left\langle [0.3051, 0.3057], 0.6981 \right\rangle\right]$ | $\left[\left\langle [0.1011, 0.1033], 0.117 \right\rangle, \left\langle [0.2051, 0.3415], 0.4951 \right\rangle\right]$ | $\left[\left\langle [0.0122, 0.0045], 0.0054 \right\rangle, \left\langle [0.0121, 0.3453], 0.5671 \right\rangle\right]$ | $\left[\left\langle [0.3001, 0.3944], 0.2342 \right\rangle, \left\langle [0.3671, 0.3745], 0.6956 \right\rangle\right]$ |

Step 3:Describe the CFEFWA operator and $\xi = (0.26, 0.21, 0.25, 0.28)$.
CFEFWA operator table 4.

| | CFEFWA operator table 4 |
|---|---|
| $PS_1$ | $[\langle [0.1201, 0.2983], 0.1492\rangle, \langle [0.2003, 0.4698], 0.3645\rangle]$ |
| $PS_2$ | $[\langle [0.4531, 0.5014], 0.2452\rangle, \langle [0.7081, 0.6047], 0.7129\rangle]$ |
| $PS_3$ | $[\langle [0.5101, 0.6134], 0.1359\rangle, \langle [0.3231, 0.1237], 0.1124\rangle]$ |
| $PS_4$ | $[\langle [0.3461, 0.1674], 0.3422\rangle, \langle [0.8951, 0.0457], 0.0081\rangle]$ |

Step 4: Find the score function $Z_1 = 0.0189, Z_2 = 0.4556, Z_3 = 0.1425, Z_4 = 0.3909$.
Step 5: The ranking is $Z_2 > Z_4 > Z_3 > Z_1$ and best is $Z_2$.

## 6. Comparsion technique with existing method

The suggested method's comparison with a different strategy based on FFSs [26] and IVFF data [46] is shown with cases in order to validate and establish its feasibility. Additional strategies are exceptional instances of our technique strategy, which is based on CFFN to the same example.

## 6.1. FF approach using the current methodology

Step 1:Table 5 in the list below represents the FF decision matrix.

| | $S$ | $F$ | $R$ | $U$ |
|---|---|---|---|---|
| $PS_1$ | $[0.1, 0.3]$ | $[0.12, 0.14]$ | $[0.9, 0.11]$ | $[0.1, 0.3]$ |
| $PS_2$ | $[0.12, 0.13]$ | $[0.4, 0.6]$ | $[0.31, 0.33]$ | $[[0.112, 0.313]$ |
| $PS_3$ | $[0.34, 0.36]$ | $[0.12, 0.13]$ | $[0.4, 0.6]$ | $[0.554, 0.556]$ |
| $PS_4$ | $[0.3004, 0.3006]$ | $[0.34, 0.36]$ | $[0.12, 0.13]$ | $[0.4, 0.6]$ |

Step 2:Define $(0.1, 0.2, 0.3, 0.5)$ and the FFWA operator.
Using the provided formula now

| | FFWA operator table 6 |
|---|---|
| $PS_1$ | $[0.1024, 0.3145]$ |
| $PS_2$ | $[0.0134, 0.2156]$ |
| $PS_3$ | $[0.0991, 0.3353]$ |
| $PS_4$ | $[0.0201, 0.3043]$ |

Step 3:Provide score function
$Z_1 = 0.0105, Z_2 = 0.4859, Z_3 = 0.1454, Z_4 = 0.3349.$
Step 4:The ranking is $Z_2 > Z_4 > Z_3 > Z_1$ and best is $Z_2$.

## 6.2. IVFF number using the current technique

Step 1:In Table 7, the IVFF choice matrix is provided.
Table 7 of the IVFF choice matrix

| | $S$ | $F$ | $R$ | $U$ |
|---|---|---|---|---|
| $PS_1$ | $\begin{bmatrix} [0.1, \\ 0.3], \\ [0.2, \\ 0.4] \end{bmatrix}$ | $\begin{bmatrix} [0.02, \\ 0.05], \\ [0.1, \\ 0.3] \end{bmatrix}$ | $\begin{bmatrix} [0.11, \\ 0.13], \\ [0.21, \\ 0.34] \end{bmatrix}$ | $\begin{bmatrix} [0.01, \\ 0.14], \\ [0.31, \\ 0.37] \end{bmatrix}$ |
| $PS_2$ | $\begin{bmatrix} [0.11, \\ 0.13], \\ [0.21, \\ 0.34] \end{bmatrix}$ | $\begin{bmatrix} [0.1, \\ 0.3], \\ [0.2, \\ 0.4] \end{bmatrix}$ | $\begin{bmatrix} [0.02, \\ 0.05], \\ [0.1, \\ 0.3] \end{bmatrix}$ | $\begin{bmatrix} [0.1, \\ 0.3], \\ [0.2, \\ 0.4] \end{bmatrix}$ |
| $PS_3$ | $\begin{bmatrix} [0.02, \\ 0.05], \\ [0.1, \\ 0.3] \end{bmatrix}$ | $\begin{bmatrix} [0.11, \\ 0.13], \\ [0.21, \\ 0.34] \end{bmatrix}$ | $\begin{bmatrix} [0.1, \\ 0.3], \\ [0.2, \\ 0.4] \end{bmatrix}$ | $\begin{bmatrix} [0.02, \\ 0.05], \\ [0.1, \\ 0.3] \end{bmatrix}$ |
| $PS_4$ | $\begin{bmatrix} [0.1, \\ 0.3], \\ [0.2, \\ 0.4] \end{bmatrix}$ | $\begin{bmatrix} [0.01, \\ 0.14], \\ [0.31, \\ 0.37] \end{bmatrix}$ | $\begin{bmatrix} [0.02, \\ 0.05], \\ [0.1, \\ 0.3] \end{bmatrix}$ | $\begin{bmatrix} [0.11, \\ 0.13], \\ [0.21, \\ 0.34] \end{bmatrix}$ |

Step 2:Describe the IVFFWA operator and $\xi = (0.26, 0.21, 0.25, 0.28)$.
IVFFWA operator table 8.

| | IVFFWA operator table 8 |
|---|---|
| $PS_1$ | $\begin{bmatrix} [0.1211, 0.3123], \\ [0.2123, 0.4123] \end{bmatrix}$ |
| $PS_2$ | $\begin{bmatrix} [0.1011, 0.1312], \\ [0.2111, 0.3234] \end{bmatrix}$ |
| $PS_3$ | $\begin{bmatrix} [0.1102, 0.2305], \\ [0.1098, 0.3123] \end{bmatrix}$ |
| $PS_4$ | $\begin{bmatrix} [0.1231, 0.3234], \\ [0.6752, 0.4125] \end{bmatrix}$ |

Step 3: Find the score function

$Z_1 = 0.1102, Z_2 = 0.5851, Z_3 = 0.2004, Z_4 = 0.4352$.

Step 4:The ranking is $Z_2 > Z_4 > Z_3 > Z_1$ and best is $Z_2$.

Different existing way Table 9

| Techniques | Score function | Ordering | Final Ordering |
|---|---|---|---|
| MCDM [45] | $\left\{ \begin{array}{c} \eta_1 = 0.0014, \\ \eta_2 = 0.7755, \\ \eta_3 = 0.1811, \\ \eta_4 = 0.3711 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ |
| IFN [9] | $\left\{ \begin{array}{c} \eta_1 = 0.1014, \\ \eta_2 = 0.4234, \\ \eta_3 = 0.1112, \\ \eta_4 = 0.3723 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ |
| FFY operators [12] | $\left\{ \begin{array}{c} \eta_1 = 0.0055, \\ \eta_2 = 0.1456, \\ \eta_3 = 0.0804, \\ \eta_4 = 0.1193 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ |
| IVIFSS operators [14] | $\left\{ \begin{array}{c} \eta_1 = 0.0126, \\ \eta_2 = 0.2255, \\ \eta_3 = 0.0712, \\ \eta_4 = 0.1456 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ | $\left\{ \begin{array}{c} \eta_2 > \\ \eta_4 > \\ \eta_3 > \\ \eta_1 \end{array} \right\}$ |

Third Column:

The items or criteria are ranked in the Organization column based on the scores indicated in the Score Function column. The performance levels or priorities that the approach has assigned are accurately represented here.

Significance: Understanding the relative ranks of the criteria for each technique depends on this column. It reflects the instantaneous result of the scoring system and shows a clear hierarchical order.

Analysis: Study how each practise arranges the criteria. For example, if System A places $\eta_2$ first and $\eta_1$ last, this indicates a strong preference for $\eta_2$ over $\eta_1$. The comparison between different techniques' orderings reveals their relative priorities and approaches.

4th Column: Final Ordering

Goal: Following the smearing of the system's score function and any additional processing or aggregation processes, the Final Ordering column provides the final ranking.

It represents the ultimate choice or front-runner because of the early score.

Significance: This column is essential to comprehending the study's outcome. It illustrates how the combined ranking or final product is determined by the scores and ordering strategies applied. This is the result that would guide choices.

Analysis: Consider how crosswise approaches are associated with the final orderings. Variations in the final orderings can indicate how various approaches have affected the position process. This comparison helps understand which approach, based on the criteria, offers a better-desired outcome. Ordering (3rd Column): This column reproduces the position of criteria founded on the scores provided in the Score Function column. It signifies the preliminary preparation or arranging of criteria by each system. For example, in the MCDM technique, the ordering of $\eta_2 > \eta_4 > \eta_3 > \eta_1$ shows a higher partiality for $\eta_2$ over other criteria.

Final Ordering (4th Column): The final ordering consolidates the rankings derived from the ordering column to present a definitive preference list. This is the final output after applying the technique's methodology. For example, the final ordering for MCDM remains $\eta_2 > \eta_4 > \eta_3 > \eta_1$, consistent with the initial ordering, reflecting that the technique maintains the same prioritization in its final output.

## 6.3. Superior

CFFSs are considered superior to IVFSs for several reasons:

Richer Information Content: While IVFSs use intervals to represent membership degrees, CFFSs extend this by also incorporating non-membership degrees as intervals. This dual interval approach provides a more comprehensive picture of the uncertainty.

Better Handling of Ambiguity: CFFSs can model situations where the degree of membership and non-membership are not only uncertain but also interdependent. This capability is crucial for more accurately capturing the nuances of human reasoning and decision-making.

Advanced Aggregation Operators: CFFSs enable the development of more sophisticated aggregation operators, such as the Dombi aggregation operators. These operators can combine information more effectively, leading to better decision-making outcomes.

To improve biomedical waste management by using advanced aggregation operators within a Fermatean fuzzy framework [51]. This research combines interval-valued Fermatean fuzzy sets with Dombi aggregation operators and the SWARA-based PROMETHEE II method to handle the uncertainty and complexity of biomedical waste management [51]. To identify the best renewable energy sources in India by using a sophisticated decision-making framework [47].

## 6.4. Advantages of Einstein Aggregation Operators

Improved Flexibility: Einstein aggregation operators provide a higher degree of flexibility compared to traditional aggregation operators. They can model a wider range of fuzzy interactions, making them suitable for complex decision-making scenarios.

Enhanced Precision: By leveraging the properties of Einstein t-norm and t-conorm, these operators allow for more precise manipulation of fuzzy sets. This precision is crucial in scenarios where the exact nature of the fuzzy interactions significantly impacts the decision outcome.

Better Handling of Uncertainty: Einstein aggregation operators are particularly effective in dealing with high levels of uncertainty and imprecision. They offer a robust framework for combining fuzzy information, which is essential for multi-criteria decision-making processes.

Compatibility with Advanced Fuzzy Sets: These operators are well-suited for advanced fuzzy sets such as cubic Fermatean fuzzy sets and q-Rung orthopair fuzzy sets, enabling their effective use in complex decision-making problems.

### 6.5. Why Einstein Aggregation Operators Defined

Einstein aggregation operators are defined to offer a novel approach to combining fuzzy information, especially in the context of decision-making processes that involve uncertainty and imprecision. These operators are based on the Einstein t-norm and t-conorm, which are mathematical functions used to generalize the concept of intersection and union in fuzzy logic. The primary motivation behind defining Einstein aggregation operators is to enhance the flexibility and applicability of fuzzy set theory in real-world scenarios, particularly those requiring nuanced handling of uncertainty.

## 7. Discussion

In this section, we have proposed the advantages and Limitations or weaknesses.

### 7.1. Advantage

- Uses Cubic Fermatean fuzzy sets to effectively manage high levels of ambiguity and imprecision.
- Presents new Einstein aggregation operators that restore the consistency and weight of the totaled choice statistics.
- Lessens bias and prejudice by allowing a wide humanoid to preside over the decision-making process.
- Completes advanced fuzzy set model and aggregation approaches with more reliable and unbiased outcomes.
- Provides a more thorough and adaptable strategy for making decisions in ambiguous situations.

Since Einstein aggregation operators are more flexible and adaptive than the Bonferroni mean, which focuses primarily on averaging, or Dombi operations, which rely on strict mathematical formulations, they are particularly effective in fuzzy and intuitionistic fuzzy environments. Their nonlinear structure allows for better representation of interactions between criteria, which ensures that the aggregated values retain important information, reducing potential distortions that may arise in other aggregation methods. However, Einstein aggregation operators offer a significant advantage in handling uncertainty and complex interrelations among fuzzy parameters. Furthermore, by being stable even while working with extremely ambiguous or imprecise data, Einstein aggregation operators improve the dependability of decision-making procedures. They are more suited for situations when conventional approaches would not be adequate because of their capacity to capture the fuzziness that exists naturally in real-world issues. Einstein operators are a popular option for complex group decision-making scenarios because they balance computational simplicity and robustness when compared to other aggregation strategies.

### 7.2. Limitation

• The system of requirements has significant computational assets and periods, which could be a limitation for real submissions.
• The accuracy of the system is highly dependent on the excellence and precision of the exertion data.
• The effort of the cubic Fermatean fuzzy Einstein aggregation operator's strength attitude challenges in application and understanding for experts not familiar with liberal fuzzy set theory.
• The technique's strength meets difficulties when applied to larger and extra compound decision-making states, perhaps cautioning its scalability.

## 8. Conclusion

Selecting the best location for EVs demonstrates a proactive role in promoting the expansion of the electric vehicle system. We have suggested a Cubic Fermatean fuzzy approach using traditional Einstein aggregation operators in CFFS contexts for EV growth. Some Einstein operators have been industrialized under a Cubic Fermatean fuzzy environment thanks to the discovery of algebraic operators. The technique has been used in an exemplary case study of the EV site assortment problem with CFFSs setting to verify its potential and efficacy. The current study involves an assessment index procedure that includes setting, budget, social, and skill elements of criteria for EV site candidates. The criteria's four elements are comprised of facts from experts, research intelligence, and writings. The suggested outline contrasts with current techniques using CFFS settings to validate the fallouts. The application procedure and the results obtained demonstrate the potential for a unified technique to be established in an industry with erratic data and a wide range of valuation criteria sizes. Nonetheless, several potential boundaries need to be assessed in the follow-up work. These include: (i) the study mishandles the contract with multilayered EV location assortment problematic with interdependent criteria; (ii) the study uses slow, unreliable data; and (iii) additional sustainability criteria may be complex in the valuation directory scheme. The method that is being described will be useful in determining the most suitable option in situations with several criteria and uncertainty. Future developments should include training, more EV sites, and more easily maintained criteria. In addition, additional training will focus on ideal constraints that account for yield growth, degree of gratification and request uncertainty, customer behavior assessment during the charging phase, and charging station profiles that account for topographical and chronological data of circulation current. Furthermore, the proposed methodology will be extended to address additional challenges within the context of CFFS, such as low-carbon sustainable supplier assortment, medical hotel interference, e-learning website assessment, and others. In the future scope, our technique could also be practical to another extension of fuzzy sets, such as quasirung fuzzy sets. Multiple attribute decision-making based on 3, 4-quasirung fuzzy sets offers a vigorous framework for management uncertainty and intricacy in decision-making situations (refer to [49] for thorough practices and requests). Including these sets might enhance the litheness and applicability of our method in many areas.

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## Declarations

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## References

[1] S. Guo and H. Zhao. Optimal site selection of electric vehicle charging station by using fuzzy topsis based on sustainability perspective. *Applied Energy*, 158:390–402, 2015.

[2] H. Khan, J. Alzabut, D. Baleanu, G. Alobaidi, and M. U. Rehman. Existence of solutions and a numerical scheme for a generalized hybrid class of n-coupled modified abc-fractional differential equations with an application. *AIMS Mathematics*, 8(3):6609–6625, 2023.

[3] H. Khan, J. Alzabut, and H. Gulzar. Existence of solutions for hybrid modified abc-fractional differential equations with p-laplacian operator and an application to a waterborne disease model. *Alexandria Engineering Journal*, 70:665–672, 2023.

[4] H. Khan, J. Alzabut, H. Gulzar, O. Tunç, and S. Pinelas. On system of variable order nonlinear p-laplacian fractional differential equations with biological application. *Mathematics*, 11(8):1913, 2023.

[5] H. Khan, J. Alzabut, A. Shah, Z. Y. He, S. Etemad, S. Rezapour, and A. Zada. On fractal-fractional waterborne disease model: A study on theoretical and numerical aspects of solutions via simulations. *Fractals*, 31(04):2340055, 2023.

[6] M. Erbaş, M. Kabak, E. Özceylan, and C. Çetinkaya. Optimal siting of electric vehicle charging stations: A gis-based fuzzy multi-criteria decision analysis. *Energy*, 163:1017–1031, 2018.

[7] X. Zhang. A novel approach based on similarity measure for pythagorean fuzzy multiple criteria group decision making. *International Journal of Intelligent Systems*, 31(6):593–611, 2016.

[8] Z. Xu and R. R. Yager. Some geometric aggregation operators based on intuitionistic fuzzy sets. *International Journal of General Systems*, 35(4):417–433, 2006.

[9] Z. S. Xu. Intuitionistic fuzzy aggregation operators. *IEEE Transactions on Fuzzy Systems*, 15(6):1179–1187, 2007.

[10] L. A. Zadeh. Fuzzy sets. *Information and Control*, 8:338–356, 1965.

[11] R. Parvathi. *Theory of operators on intuitionistic fuzzy sets of second type and their applications to image processing.* PhD thesis, PhD thesis, 2005.

[12] H. Garg, G. Shahzadi, and M. Akram. Decision-making analysis based on fermatean fuzzy yager aggregation operators with application in covid-19 testing facility. *Mathematical Problems in Engineering*, 2020.

[13] S. B. Aydemir and S. Yilmaz Gunduz. Fermatean fuzzy topsis method with dombi aggregation operators and its application in multi-criteria decision making. *Journal of Intelligent & Fuzzy Systems*, 39(1):851–869, 2020.

[14] T. Y. Chen. The extended linear assignment method for multiple criteria decision analysis based on interval-valued intuitionistic fuzzy sets. *Applied Mathematical Modelling*, 38(7–8):2101–2117, 2014.

[15] T. Y. Chen. Interval-valued intuitionistic fuzzy qualiflex method with a likelihood-based comparison approach for multiple criteria decision analysis. *Information Sciences*, 261:149–169, 2014.

[16] T. Y. Chen. An interval-valued pythagorean fuzzy outranking method with a closeness-based assignment model for multiple criteria decision making. *International Journal of Intelligent Systems*, 33(1):126–168, 2018.

[17] S. J. Wu and G. W. Wei. Pythagorean fuzzy hamacher aggregation operators and their application to multiple attribute decision making. *International Journal of Knowledge-based and Intelligent Engineering Systems*, 21(3):189–201, 2017.

[18] Q. Wang, R. Li, and R. Jiang. Decoupling and decomposition analysis of carbon emissions from industry: A case study from china. *Sustainability*, 8(10):1059, 2016.

[19] M. Akram, G. Shahzadi, A. A. H. Ahmadini, and T. Mahmood. Decision-making framework for an effective sanitizer to reduce covid-19 under fermatean fuzzy environment. *Journal of Mathematics*, pages 1–19, 2020.

[20] K. T. Atanassov. Intuitionistic fuzzy sets. *Fuzzy Sets and Systems*, 20(1):87–96, 1986.

[21] R. R. Yager. Pythagorean membership grades in multicriteria decision making. *IEEE Transactions on Fuzzy Systems*, 22(4):958–965, 2014.

[22] W. Yang. A user-choice model for locating congested fast charging stations. *Trans-*

*portation Research Part E: Logistics and Transportation Review*, 110:189–213, 2018.

[23] Yu. Yang, J. Q. Wang, and J. Wang. A vikor-based framework to optimize the location of fast-charging stations with proportional hesitant fuzzy information. *Journal of Intelligent & Fuzzy Systems*, 39(3):2581–2596, 2020.

[24] E. P. Sarabi and S. A. Darestani. Developing a decision support system for logistics service provider selection employing fuzzy multimoora & bwm in mining equipment manufacturing. *Applied Soft Computing*, 2021.

[25] T. Senapati and R. R. Yager. Fermatean fuzzy sets. *Journal of Ambient Intelligence and Humanized Computing*, 11(2):663–674, 2020.

[26] T. Senapati and R. R. Yager. Some new operations over fermatean fuzzy numbers and application of fermatean fuzzy wpm in multiple criteria decision making. *Informatica*, 30(2):391–412, 2019.

[27] T. Senapati and R. R. Yager. Fermatean fuzzy weighted averaging/geometric operators and its application in multi-criteria decision-making methods. *Engineering Applications of Artificial Intelligence*, 85:112–121, 2019.

[28] N. Shahraki, H. Cai, M. Turkay, and M. Xu. Optimal locations of electric public charging stations using real world vehicle travel patterns. *Transportation Research Part D: Transport and Environment*, 41:165–176, 2015.

[29] S. Singh and A. H. Ganie. On some correlation coefficients in pythagorean fuzzy environment with applications. *International Journal of Intelligent Systems*, 35(4):682–717, 2020.

[30] D. Stanujkic, E. K. Zavadskas, F. Smarandache, W. K. M. Brauers, and D. Karabasevic. A neutrosophic extension of the multimoora method. *Informatica*, 28(1):181–192, 2017.

[31] D. Stanujkic, D. Karabasevic, E. K. Zavadskas, F. Smarandache, and W. K. M. Brauers. A bipolar fuzzy extension of the multimoora method. *Informatica*, 30(1):135–152, 2019.

[32] A. Fahmi, S. Abdullah, F. Amin, N. Siddiqui, and A. Ali. Aggregation operators on triangular cubic fuzzy numbers and its application to multi-criteria decision making problems. *Journal of Intelligent & Fuzzy Systems*, 33(6):3323–3337, 2017.

[33] F. Amin, A. Fahmi, S. Abdullah, A. Ali, R. Ahmad, and F. Ghani. Triangular cubic linguistic hesitant fuzzy aggregation operators and their application in group decision making. *Journal of Intelligent & Fuzzy Systems*, 34(4):2401–2416, 2018.

[34] A. Fahmi, S. Abdullah, F. Amin, and M. Khan. Trapezoidal cubic fuzzy number einstein hybrid weighted averaging operators and its application to decision making. *Soft Computing*, 23(14):5753–5783, 2019.

[35] A. Fahmi, S. Abdullah, F. Amin, and A. Ali. Weighted average rating (war) method for solving group decision making problem using triangular cubic fuzzy hybrid aggregation (tcfha) operator. *Punjab University Journal of Mathematics*, 50(1), 2020.

[36] A. Fahmi, F. Amin, S. Abdullah, and A. Ali. Cubic fuzzy einstein aggregation operators and its application to decision-making. *International Journal of Systems Science*, 49(11):2385–2397, 2018.

[37] A. Fahmi, A. Khan, and T. Abdeljawad. Group decision making based on cubic fer-

matean einstein fuzzy weighted geometric operator. *Ain Shams Engineering Journal*, 15(4):102737, 2024.

[38] H. Khan, J. Alzabut, M. Tounsi, and D. K. Almutairi. Ai-based data analysis of contaminant transportation with regression of oxygen and nutrients measurement. *Fractal & Fractional*, 9(2), 2025.

[39] J. Liu and Q. Wei. Risk evaluation of electric vehicle charging infrastructure public-private partnership projects in china using fuzzy topsis. *Journal of Cleaner Production*, 189:211–222, 2018.

[40] F. Samaie, S. Javadi, H. Meyar-Naimi, and H. Feshki-Farahani. Environmental sustainability policy on plug-in hybrid electric vehicle penetration utilizing fuzzy topsis and game theory. *Clean Technologies and Environmental Policy*, 22:787–801, 2020.

[41] J. C. Wang and T. Y. Chen. Likelihood-based assignment methods for multiple criteria decision analysis based on interval-valued intuitionistic fuzzy sets. *Fuzzy Optimization and Decision Making*, 14(4):425–457, 2016.

[42] S. Deb, K. Tammi, K. Kalita, and P. Mahanta. Impact of electric vehicle charging station load on distribution network. *Energies*, 11:1–25, 2018.

[43] S. Turk, M. Deveci, E. Ozcan, F. Canıtez, and R. John. Interval type-2 fuzzy sets improved by simulated annealing for locating the electric charging stations. *Information Sciences*, 547:641–666, 2021.

[44] X. Zhang and Z. Xu. Extension of topsis to multiple criteria decision making with pythagorean fuzzy sets. *International Journal of Intelligent Systems*, 29(12):1061–1078, 2014.

[45] S. Zeng, Z. Mu, and T. Baležentis. A novel aggregation method for pythagorean fuzzy multiple attribute group decision making. *International Journal of Intelligent Systems*, 33(3):573–585, 2018.

[46] P. Rani and A. R. Mishra. Interval-valued fermatean fuzzy sets with multi-criteria weighted aggregated sum product assessment-based decision analysis framework. *Neural Computing and Applications*, 34(10):8051–8067, 2022.

[47] M. R. Seikh and P. Chatterjee. Determination of best renewable energy sources in india using swara-aras in confidence level based interval-valued fermatean fuzzy environment. *Applied Soft Computing*, 155:111495, 2024.

[48] M. R. Seikh and U. Mandal. Some picture fuzzy aggregation operators based on frank t-norm and t-conorm: Application to madm process. *Informatica*, 45(3), 2021.

[49] M. R. Seikh and U. Mandal. Multiple attribute decision-making based on 3, 4-quasirung fuzzy sets. *Granular Computing*, pages 1–14, 2022.

[50] M. R. Seikh and U. Mandal. Multiple attribute group decision making based on quasirung orthopair fuzzy sets: Application to electric vehicle charging station site selection problem. *Engineering Applications of Artificial Intelligence*, 115:105299, 2022.

[51] M. R. Seikh and U. Mandal. Interval-valued fermatean fuzzy dombi aggregation operators and swara based promethee ii method to bio-medical waste management. *Expert Systems with Applications*, 226:120082, 2023.

[52] M. R. Seikh and U. Mandal. q-rung orthopair fuzzy archimedean aggregation operators: Application in the site selection for software operating units. *Symmetry*,

15(9):1680, 2023.

[53] H. Khan, J. Alzabut, and A. Alkhazzan. Qualitative dynamical study of hybrid system of pantograph equations with nonlinear p-laplacian operator in banach's space. *Results in Control and Optimization*, 15:100416, 2024.

[54] H. Khan, J. Alzabut, and D. K. Almutairi. Applications of artificial intelligence for clusters analysis of uranium decay via a fractional order discrete model. *Partial Differential Equations in Applied Mathematics*, 13:101056, 2025.

[55] A. K. Das and C. Granados. Ifp-intuitionistic multi fuzzy n-soft set and its induced ifp-hesitant n-soft set in decision-making. *Journal of Ambient Intelligence and Humanized Computing*, 14(8):10143–10152, 2023.

[56] A. K. Das and C. Granados. A new fuzzy parameterized intuitionistic fuzzy soft multiset theory and group decision-making. *Journal of Current Science and Technology*, 12(3):547–567, 2022.

[57] A. K. Das, N. Gupta, T. Mahmood, B. C. Tripathy, R. Das, and S. Das. An innovative fuzzy multi-criteria decision making model for analyzing anthropogenic influences on urban river water quality. *Iran Journal of Computer Science*, pages 1–22, 2024.

[58] A. K. Das, N. Gupta, and C. Granados. Weighted hesitant bipolar-valued fuzzy soft set in decision-making. *Songklanakarin Journal of Science Technology*, 45(6), 2023.

[59] A. K. Das and C. Granados. An advanced approach to fuzzy soft group decision-making using weighted average ratings. *SN Computer Science*, 2(6):471, 2021.